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CHROMATOGRAPHY: SOME GENERALITIES

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Chromatography is perhaps the most useful means of separating compounds to purify and identify them. Indeed, separations of colored compounds on paper strips gave the technique its colorful name. Although there are many different types of chromatography, all the forms bear tremendously striking similarities. **Thin-layer, wet-column, and dry-column chromatography** are common techniques you'll run across.

This chromatography works by differences in **polarity**. (That's not strictly true for all types of chromatography, but I don't have the inclination to do a 350-page dissertation on the subject, when all you might need to do is separate the differently colored inks in a black marker pen.)

ADSORBENTS

The first thing you need is an **adsorbent**, a porous material that can suck up liquids and solutions. Paper, silica gel, alumina (ultrafine aluminum oxide), corn starch, and kitty litter (unused) are all fine adsorbents. Only the first *three* are used for chromatography, however. You may or may not need a **solid support** with these. Paper hangs together, is fairly stiff, and can stand up by itself. Silica gel, alumina, corn starch, and kitty litter are more or less powders and will need a solid support to hold them.

Now you have an *adsorbent on some support*, or a *self-supporting adsorbent*, like a strip of paper. You also have a mixture of stuff you want to separate. So you dissolve the mixture in an easily evaporated solvent, like methylene chloride, and put some of it on the adsorbent. *Zap!* It is adsorbed! Stuck on and held to the adsorbent. But because you have a mixture of different things, and they are different, they will be *held to the adsorbent in differing degrees*.

SEPARATION OR DEVELOPMENT

Well, now there's this mixture, sitting on this adsorbent, looking at you. Now you start to *run solvents through the adsorbent*. Study the following list of solvents. Chromatographers call these solvents **eluents**.

THE ELUATROPIC SERIES

Not at all like the World Series, **the eluatropic series** is simply a list of solvents arranged according to increasing polarity.

**Some solvents arranged in
order of increasing polarity**

(Least polar)	Pet. ether
	Cyclohexane
Increasing	Toluene
Polarity	Chloroform
	Acetone
	Ethanol
(Most polar)	Methanol

So you start running “pet. ether” (remember, petroleum ether, a mixture of hydrocarbons like gasoline—not a true ether at all). It’s not very polar. So it is *not held strongly to the adsorbent*.

Well, this solvent is traveling through the adsorbent, minding its own business, when it encounters the mixture placed there earlier. It tries to kick the mixture out of the way. But most of *the mixture is more polar, held more strongly* on the adsorbent. Since the pet. ether cannot kick out the compounds that are more polar than itself very well, most of *the mixture is left right where you put it*.

No separation

Desperate, you try methanol, one of the most polar solvents. It is *really held strongly to the adsorbent*. So it comes along and kicks the living daylight out of just about *all* the molecules in the mixture. After all, the methyl alcohol *is more polar, so it can move right along and displace the other molecules*. And it does. So, when you evaporate the methanol and look, *all the mixture has moved with the methanol*, so you get *one spot* that moved, right with the **solvent front**.

No separation

Taking a more reasonable stand, you try chloroform, because it has an intermediate polarity. The chloroform comes along, sees the mixture, and is able to push out, say, *all but one* of the components. As it travels, kicking the rest along, it gets tired and starts to leave some of the more polar components behind. After a while, *only one component is left moving with the chloroform*, and that may be dropped, too. So, at the end, *there are several spots left*, and each of them is in a *different place* from the start. Each spot is *at least one different component* of the entire mixture.

Separation. At last!

I picked these solvents for illustration. They are quite commonly used in this technique. I worry about the hazards of using chloroform, however, because it's been implicated in certain cancers. Many other common solvents, also, are suspected to be carcinogens. In lab, either you will be told what solvent (eluent) to use or you will have to find out yourself, mostly by trial and error.